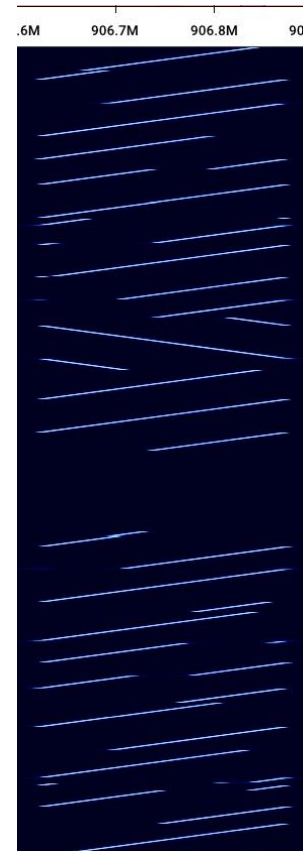


Meshtastic Universal Sensor Interface Concept

- Using the Meshtastic Serial Module as an ISM (Industrial, Scientific, Medical) data link to interface non-Meshtastic supported sensors using I2C, SPI, Can, Mod, UART, I/O and/or other communication protocols.



Meshtastic Telemetry Supported Sensor Types

Telemetry Paradigm

- Predominately consumer centric, I2C sensors.
 - Interfacing software organic to the Meshtastic OS.
 - Setup and collection interval set in software.
 - Data displayed on OLED screen and in Node metrics.
- ! **“...other interesting sensor types and use cases we need to add a portnum for more generic telemetry packets and a second MCU will be required to interact with the sensor and process the data to be sent over the mesh.”**

Supported Sensor Suite

- Temperature, barometric pressure, humidity, wind direction, wind speed, and air resistance, Tip Bucket Rain counter
- Light intensity
- UV Light intensity
- Concentration units and particle counts by size
- Radio Dosimeter
- Heart Rate, Oxygen Saturation, and body temperature
- Current and Voltage
- 24-Bit differential ADC for Wheatstone bridge

Extensive Sensors Not Supported By Meshtastic OS

Sample of Non-Supported Sensors

- High Pressure (combustion)
- Vibration/Accelerometers
- Proximity
- Boutique On-device, FFT Processed 3-Axis Accelerometers
- Fluid Depth
- Fluid Flow
- Megger
- RTD
- Etc.

Common Sensor Outputs

- CAN bus
- MOD bus
- ADC
- SPI
- I2C
- I/O
- UART
- 2-Wire Current Loop
- 3-Wire Variable Voltage

Motivation

- Limited ability to modify supported sensor operations without changing the Meshtastic OS
 - If user makes changes, they will unlikely be incorporated into updates to the Meshtastic OS
 - Therefore user changes would have to manually imported into any OS updates
 - Conflicts possible requiring debugging OS changes
- Better to use the Serial Module than change the Meshtastic OS
 - More portable
 - Direct user control

Advantages of MCU Control of Sensor

- Flexible collection interval
 - Fixed
 - Adjustable
 - Dynamic (based on data rate of change)
 - On demand
 - Other?

Meshtastic Serial Module as Data Link Paradigm

How It Works

Serial Module RX Pin

- External MCU controls attached sensors via appropriate protocols.
 - Some basic data manipulation and formatting by MCU
- Convert collected data to ASCII Format
- Send data to Meshtastic Serial Module (RX pin) via UART @ 115200 baud
- Meshtastic creates “Packet”
 - Adds Preamble HEX DA (/CR/LF)
 - Adds Node ID Address
 - Adds Data
 - Adds Postamble HEX DA
- Packet transmitted via Channel 0

Serial Module TX Pin

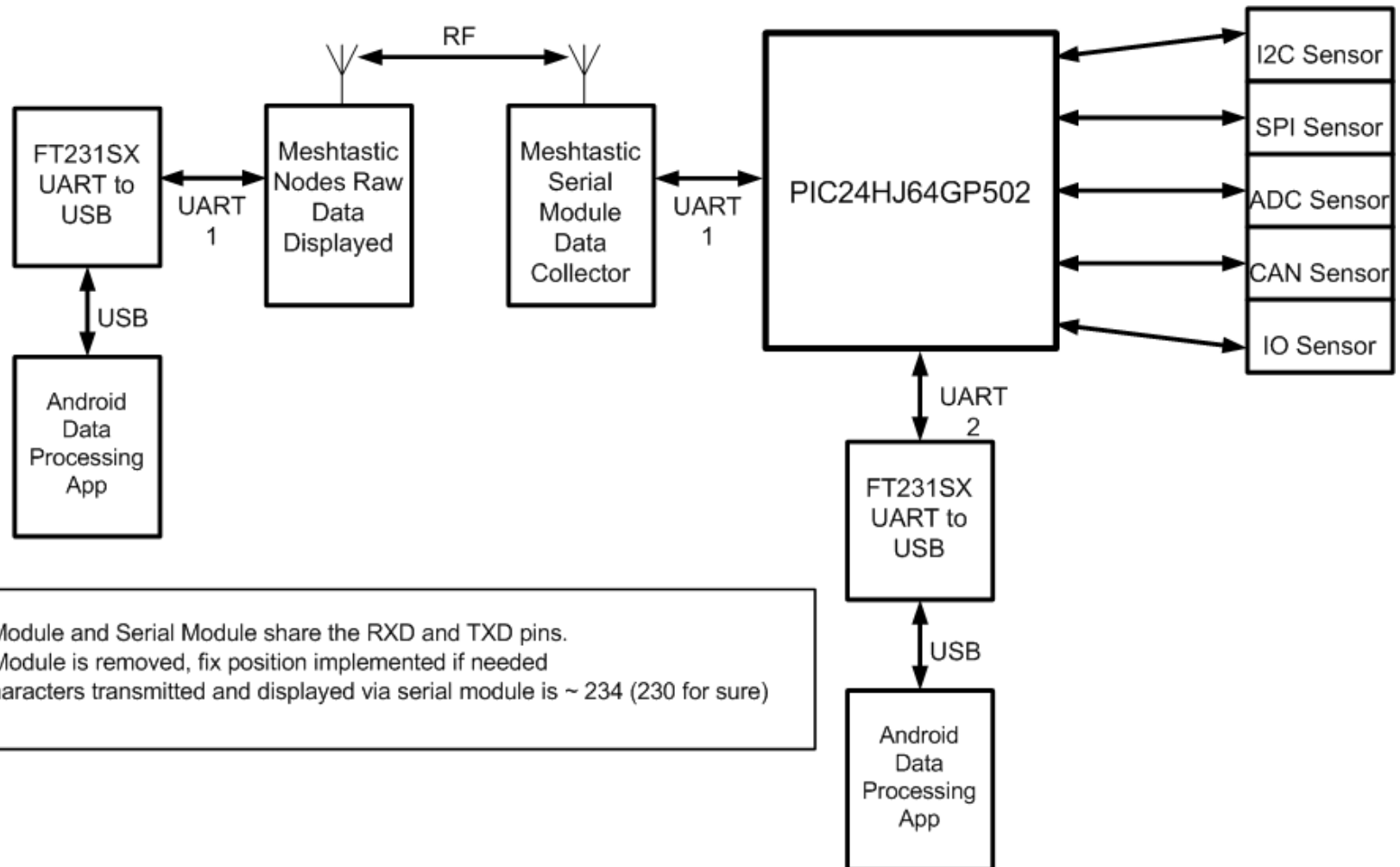
- Meshtastic Serial Module receives Packet on Channel 0
- Outputs Packet on Meshtastic Serial Module TX pin via UART @115200 baud to FTDI FT231

Android Processing App

- Receives Packet via FT231 Converter on USB Port @115200 baud
- Strips Pre/Post Ambles
- Parses Address
- Manipulates recovered data
- Displays recovered data

Universal Meshtastic Sensor Interface Concept

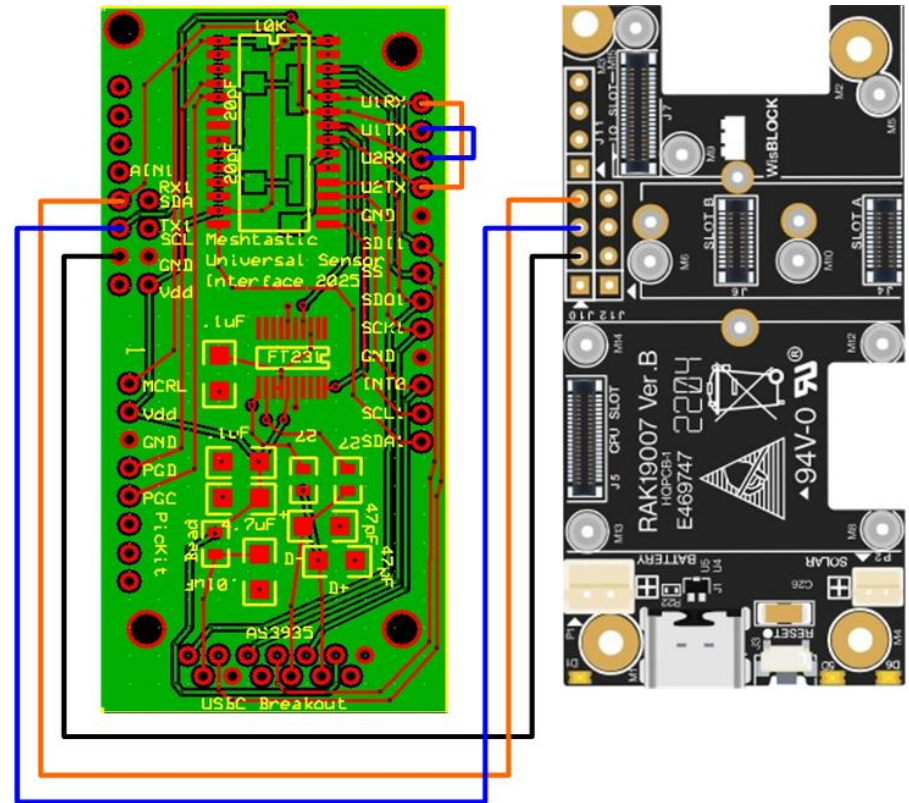
Universal Meshtastic Sensor Interface Concept



Universal Meshtastic Sensor Interface

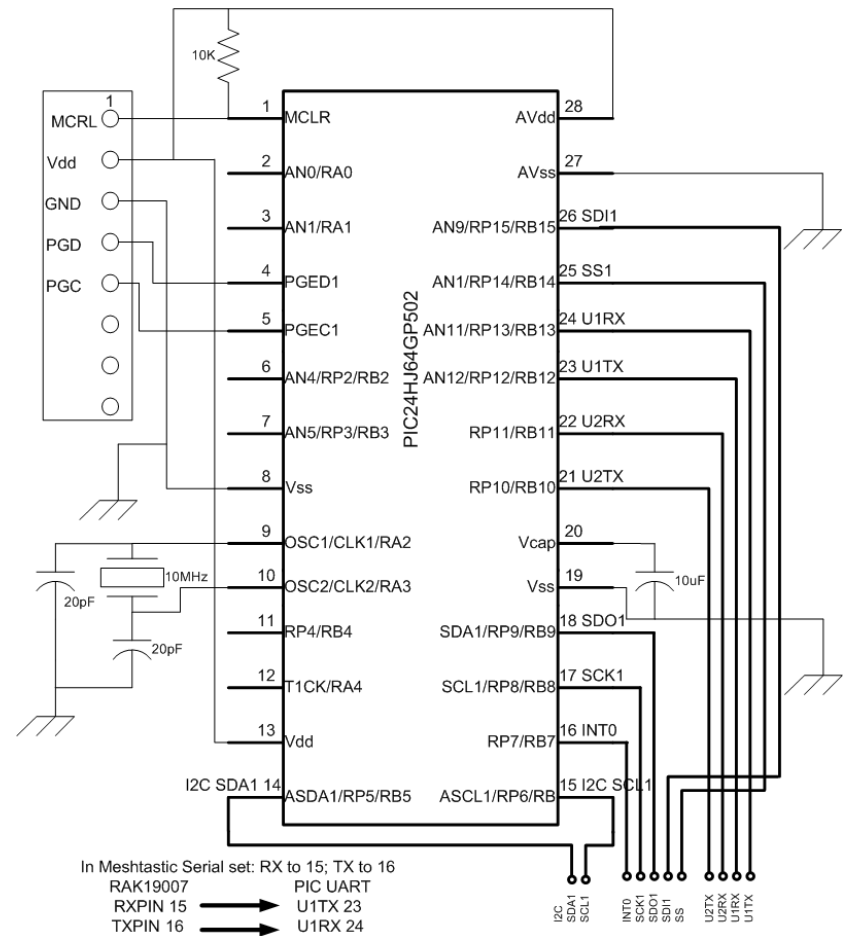
Consists of Two Components

1. Standardize PCB “Hat”
mounted on and
connected to RAK19007
Motherboard
 - PCB Populated for:
 - Sensor control and data collection, data transmission to Serial Module (MCU)
 - Data reception from Serial Module (FT321)
2. Android App programmed
for sensor control, data
manipulation, and display



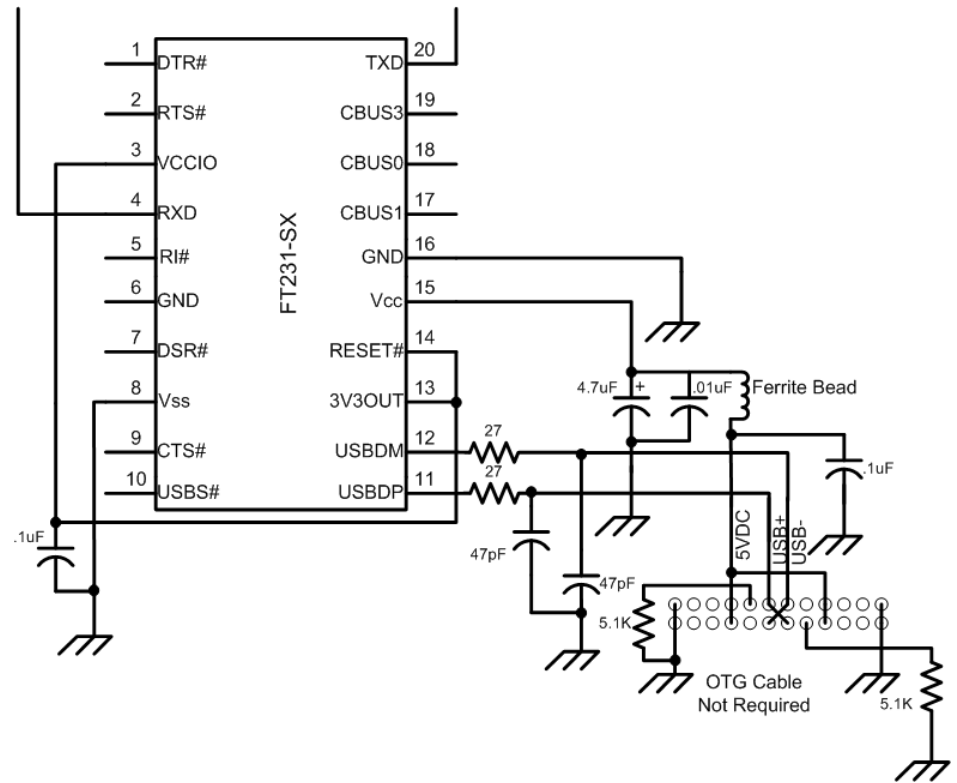
Sensor Interface MCU

- Microchip PIC24HJ64
 - Multiple-ADCs
 - 2-I2Cs
 - 2-SPI
 - 2-UARTs
 - Cam and Mod Modules
 - Many others
- MPLabX IDE
- C programming



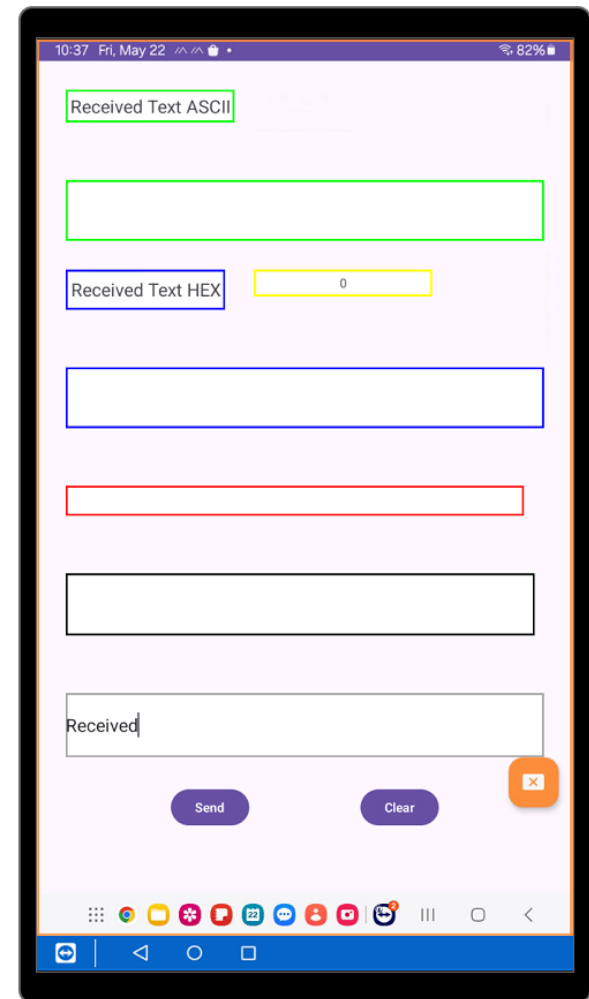
FTDI FT231 USB to Serial Converter

- FT231 USB to Serial (UART) Converter
- Stable Windows and Linux Drivers
- Virtual Comm. Port
- As designed no OTG cable required (by the 5.1K resistors)



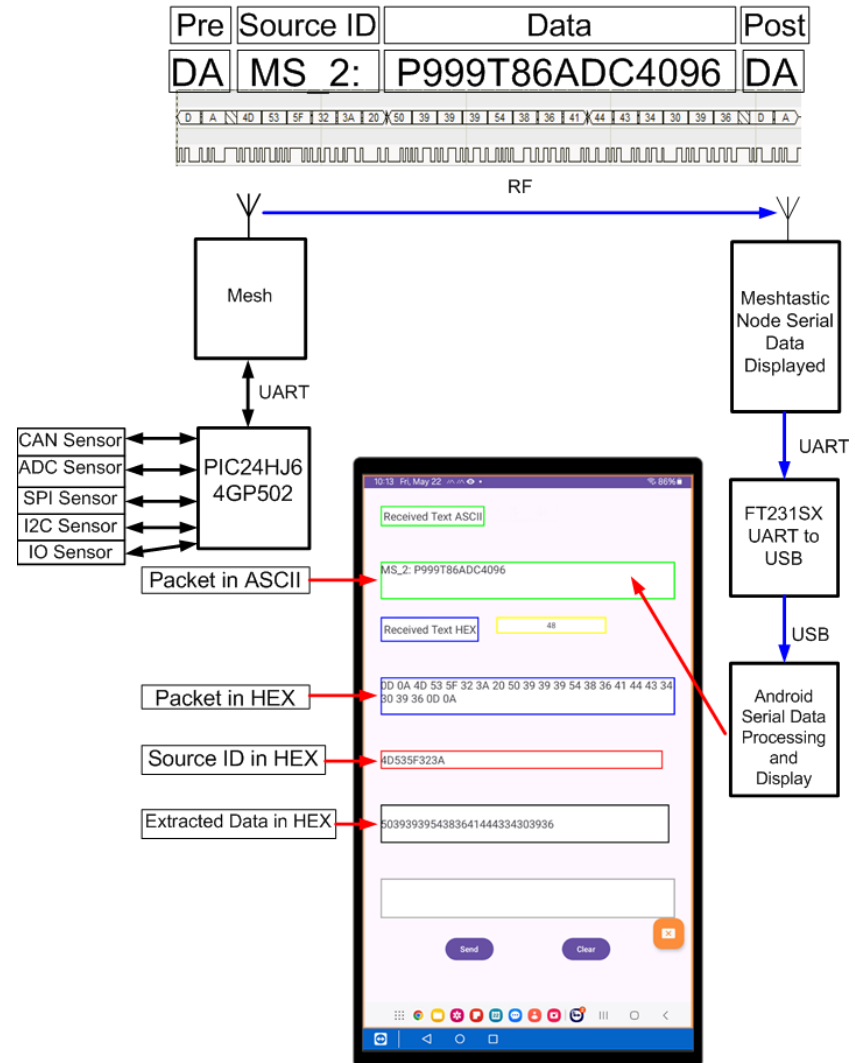
Android Data Manipulation and Display

- Android App Template
- Code developed in Android Studio and Java
- Template modifiable to user needs for data manipulation and presentation, sensor control, stimulate data collection
- Provides a starting point for app development



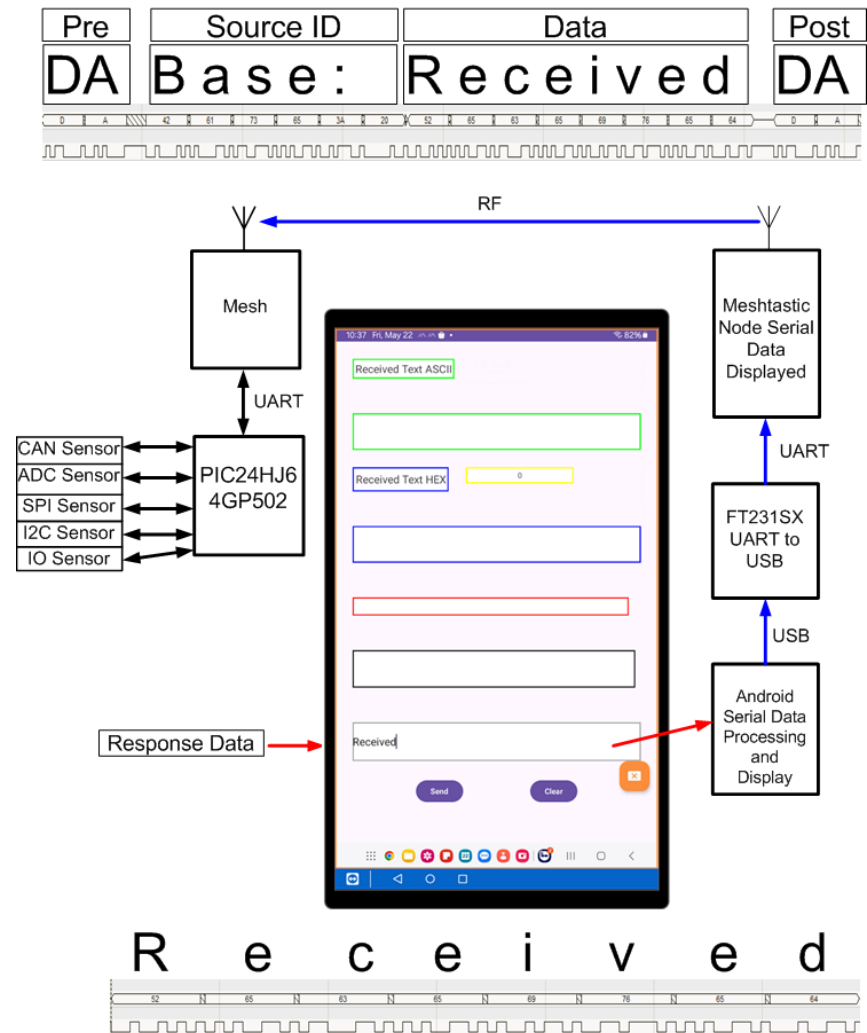
Sensor Data Capture and Transmission Process Example

- Pressure, Temperature, ADC data collected from sensors via PIC24 program
- Translated in ASCII values with data ID inserted
- Transferred to Meshtastic Node via Serial UART
- Pre/Source ID/Post added by Meshtastic OS
- Transmitted to Mesh via Channel 0
- Receive by Meshtastic Node(s)
- Transferred to USB to Serial Converter via Serial UART
- Sent to Android App via USB port
- Data processed and displayed by Android App



Sensor Control and/or Acknowledgement Process Example

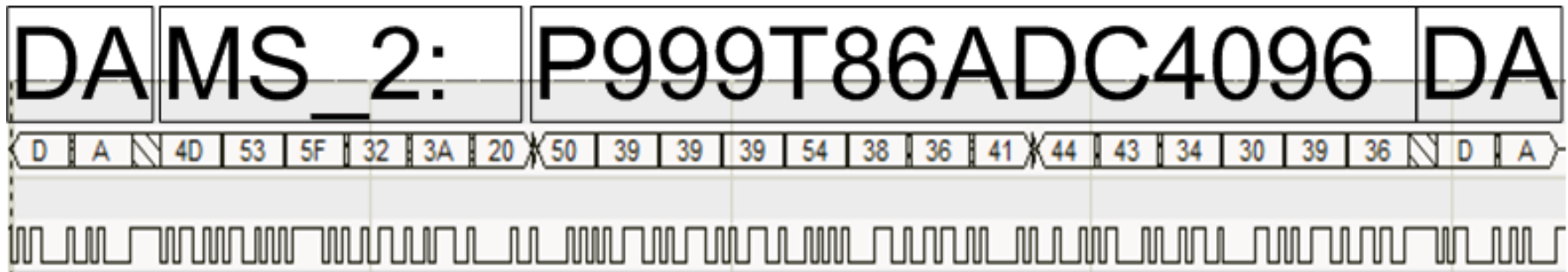
- Any acknowledgement or other control data is sent from Android App to USB to Serial Converter
- Data transferred to Serial Module TX line of Meshtastic Node
- Node adds Pre/Source ID/Post information to create Packet
- Node transmits Packet to Mesh
- Receiving Node strips Pre/Source ID/Post to recover Data and MCU takes appropriate action (collect data and/or display information on OLED screen and/or pass data to attached Android for processing)



Examples Using Mestastic Serial Module As Data Link

- Mine operation Mesh monitoring the position of equipment and condition of diesel engines
- Pivot irrigation Mesh monitoring the rotational location of the pivot, water flow rates to distribution nozzles
- Railroad train Mesh monitoring the condition of railroad truck roller bearings for vibration signature changes that indicate imminent failure and possible derailment
- Domestic water well Mesh monitoring storage tank capacity, well pump condition, well pump output, and auxiliary water pump flow rates

Packet Details: ASCII, HEX, UART Bit Stream



Data Details: ASCII, HEX, UART Bit Stream

